

# **Our Environment**

# **Our Impact**

# **Our Responsibility**

**A collection of problem-based learning activities developed and field-tested for the Ministry of Education's new Environmental Science, Grade 11, Workplace Preparation (SVN3E) course**

## **Project Manager**

Maureen Callan, Ministry of Education

## **Writers**

Stewart Grant, Toronto District School Board

Linda Oliverio, District School Board of Niagara

Sandra Orr, District School Board of Niagara

## **Contributors**

Mike Laing, Blue Water District School Board

Jason Pilot, Lakehead District School Board

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## Introduction

This course is designed to provide students with the fundamental knowledge of concepts relating to environmental science and a skill set that will help them to achieve success in the world of work and life after secondary school.

With successful student achievement measured in terms of literacy, numeracy, use of technology, skill and character development, and the embracing of a sense of environmental stewardship, the new curriculum's "Big Ideas", "Overall Expectations" and "Specific Expectations" were met through numerous "project-based" activities and "action research". In each unit, students were provided with all of the background information and scientific theory necessary to complete various tasks and activities that, in the end, allowed them to kinaesthetically explore current environmental issues and lifestyle choices that directly impact upon the environment.

This resource package is divided into the specific projects and activities written and delivered for the pilot course. Throughout the package, each of the projects/activities is broken down into its overall goal, the checkpoints used to assess for learning, the suggested lesson sequence, ready-to-use worksheets, and a list of helpful resources used to carry out the project/activity.

It should be emphasized that the intent of this resource is to act as a tool to help educators meet the expectations of the course rather than to be a prescriptive "how to" guide for teaching the course. Further, rubrics need to be reflective of the task evaluated. That is why only the *Air Biofilter Project* contains a rubric. Moreover, you will note that the *Waste Management* activity is incomplete as only the overall expectations, a lesson to start the activity and suggested resources are listed. The intent was to allow the educator to develop a task for their class that was relevant to their region.

In utilizing a "project-based" approach to the course, our rationale was to create tasks and activities that could spread across more than one specific unit, could address multiple expectations at once, and that would focus on current environmental issues that could vary from region to region. The course material itself is extremely fluid and will always remain contemporary; the material does not have to be delivered or presented unit-by-unit, and there are many different ways to address the curriculum expectations. Finally, any of the tasks or activities incorporated in this resource package can be modified and used as final culminating assessments.

## Getting to know your students

The fact that students come in all shapes and sizes is more than just a reference to a student's physical characteristics – it also refers to their cognitive characteristics. How do they like to learn? Where do they like to study? When are they most alert? What are their likes? Dislikes? How are they intelligent? are just a few of the questions that can be used to probe a student's cognitive make-up. The answers to these questions benefit both the educator and the student.

The educator benefits by gaining information that is helpful when it comes to the creation of groups; in the development of rich learning tasks; or in the delivery of course content, to name a few. As for the student, they are able to self-assess and reflect on how they like to learn. Such meta-cognitive skills are beneficial in helping them to become life-long learners.

As such, spending some time at the beginning of the course getting to know your students through interest inventories, intelligence profiles and non-threatening activities is time that will provide you with a wealth of information. The intent of the worksheets that follow (*20 Interesting Facts about Me!*; *How Do You Like to Learn?*; *How Are You Intelligent?*; and *What is Your Unique Intelligence Profile?*) is for the purpose of gathering such information.

Although not included in this resource, an activity whose intent it to create a safe learning environment for your students is described in Dennis Smithenry's and Joan Bolos' article *Creating a Scientific Community*. In the article, the authors explain the importance of emphasizing climate, trust, safety, and cooperation in your class. This should be done in the first couple weeks of the course, the authors' state, so that the class will function successfully as a scientific community.

By getting to know your students and creating a learning environment in which they feel safe offering their opinion, sharing their experiences, or exploring their interests, you will notice your students becoming more engaged in the learning process.

Name: \_\_\_\_\_

But I preferred to be addressed by? \_\_\_\_\_

Student Number: \_\_\_\_\_

Home Phone Number: \_\_\_\_\_

Course: \_\_\_\_\_

In case you should need to talk with a parent or guardian, please talk with my:

Please help me to get to know you better.

### **20 Interesting Facts about You!\***

1. Language(s) in which I am able to communicate: \_\_\_\_\_
2. Other activities that I like to do are: \_\_\_\_\_
3. My favourite subject is: \_\_\_\_\_
4. In my free time, I \_\_\_\_\_
5. On TV, I like to watch \_\_\_\_\_
6. The music I listen to is \_\_\_\_\_
7. I think a teacher should \_\_\_\_\_ and \_\_\_\_\_
8. My favourite movies are \_\_\_\_\_ and \_\_\_\_\_
9. I like my family because \_\_\_\_\_
10. The most interesting person whom I have met is \_\_\_\_\_ because  
\_\_\_\_\_
11. My job outside of school is \_\_\_\_\_. How often? \_\_\_\_\_
12. I volunteer at \_\_\_\_\_. How often? \_\_\_\_\_
13. If I had \$500, I would \_\_\_\_\_
14. I am in this science class because \_\_\_\_\_
15. I think this class will be (easy/difficult) because \_\_\_\_\_
16. I am excited about this class because \_\_\_\_\_
17. I am fearful of this class because \_\_\_\_\_
18. The things I will do in this call to be successful are \_\_\_\_\_
19. The things that may prevent me from being successful are \_\_\_\_\_
20. Something that I want you to know about me is \_\_\_\_\_

\*Adapted from *Differentiated Instructional Strategies* by Gayle H. Gregory and Carolyn Chapman

## How Do You Like to Learn?\*

1. Do you like music on while you study, or do you prefer a quiet place?

Quiet

Music

2. Where would you prefer to work on an assignment?

Classroom

Desk (home)

On the floor

At a table

At a computer

3. If you are not able to complete something, is it because

You forgot?

You are bored?

You got distracted?

You need help?

4. Where do you like to sit in class?

Near the door

Front

By the wall

Near a window

Back

5. How do you like to work?

\_\_\_\_\_ by yourself      \_\_\_\_\_ with a partner      \_\_\_\_\_ in a small group

6. Are you more alert in the afternoon? In the evening? In the morning?

7. What classes do you enjoy and why?

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8. Describe how you study. Where? When? How?

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9. If you have an assignment due in 2 weeks, how do you plan to complete it?

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10. If something is new for you, do you

Like to have it explained?

Like to read about it?

Like to watch a video/demonstration

Like to just try it?

\*Adapted from *Differentiated Instructional Strategies* by Gayle H. Gregory and Carolyn Chapman

## How Are You Intelligent?\*

Place check marks next to all the descriptions that best describe you.

### VERBAL/LINGUISTIC

#### INTELLIGENCE (Word Smart)

- I like to tell jokes, tell stories or tales.
- Books are important to me.
- I like to read.
- I often listen to radio, TV, tapes, or CDs.
- I write easily and enjoy it.
- I quote things I've read.
- I like crosswords and word games.

### LOGICAL/MATHEMATICAL

#### INTELLIGENCE (Math Smart)

- I solve math problems easily.
- I enjoy math and using computers.
- I like strategy games.
- I wonder how things work.
- I like using logic to solve problems.
- I reason things out.
- I like to use data in my work to measure, calculate, and analyze.

### INTERPERSONAL

#### INTELLIGENCE (People Smart)

- People ask me for advice.
- I prefer team sports.
- I have many close friends.
- I like working in groups.
- I'm comfortable in a crowd.
- I have empathy for others.
- I can figure out what people are feeling.

### MUSICAL/RHYTHMIC

#### INTELLIGENCE (Music Smart)

- I like to listen to musical selections.
- I am sensitive to music and sounds.
- I can remember tunes.
- I listen to music when studying.
- I enjoy singing.
- I keep time to music.
- I have a good sense of rhythm.

### INTRAPERSONAL

#### INTELLIGENCE (Self Smart)

- I know about my feelings, strengths, and weaknesses.
- I like to learn more about myself.
- I enjoy hobbies by myself.
- I enjoy being alone sometimes.
- I have confidence in myself.
- I like to work alone.
- I think about things and plan what to do next.

### VISUAL/SPATIAL

#### INTELLIGENCE (Picture Smart)

- I shut my eyes and see clear pictures.
- I think in pictures.
- I like colour and interesting designs.
- I can find my way around unfamiliar areas.
- I draw and doodle.
- I like books with pictures, maps, and charts.
- I like videos, movies, and photographs.

### BODILY/KINESTHETIC

#### INTELLIGENCE (Body Smart)

- I get uncomfortable when I sit too long.
- I use my hand when speaking.
- I like working with my hands on crafts/hobbies.
- I touch things to learn more about them.
- I think of myself as well coordinated.
- I learn by doing rather than watching.

### NATURALIST (Nature Smart)

- I enjoy spending time in nature.
- I like to classify things into categories.
- I can hear animal and bird sounds clearly.
- I see details when I look at objects in nature (e.g., plants, a land form, etc).
- I am happiest outdoors.
- I like tending to plants and animals.
- I know the names of trees, plants, birds, and animals.

\*Adapted from *Differentiated Instructional Strategies* by Gayle H. Gregory and Carolyn Chapman

## What Is Your Unique Multiple Intelligence Profile?\*

Now shade in the number of boxes below that match the number of checks you made for each *Intelligence* listed above.

<b>Word Smart</b>							
<b>Math Smart</b>							
<b>People Smart</b>							
<b>Music Smart</b>							
<b>Self Smart</b>							
<b>Picture Smart</b>							
<b>Body Smart</b>							
<b>Nature Smart</b>							

\*Adapted from *Differentiated Instructional Strategies* by Gayle H. Gregory and Carolyn Chapman

## Evaluation Activities

Air Bio-Filter Project	
Assessment of Learning:	<p><b>Goal</b></p> <p>Students will work in groups to design and build an indoor air bio-filter which they will monitor and evaluate.</p> <p><b>Standards for Student Success</b></p> <p>Students will create a presentation that must include:</p> <ul style="list-style-type: none"> <li>➤ a description of the project</li> <li>➤ materials used in the construction of the air bio-filter</li> <li>➤ pictures/diagrams illustrating the functioning of the air bio-filter</li> <li>➤ a discussion of the effectiveness of their air bio-filter and recommendations for improvement</li> </ul> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>B2.</b> investigate air quality in natural and disturbed environments, using appropriate technology;</p> <p><b>B3.</b> demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored;</p> <p><b>C1.</b> analyse the effects on human health of environmental contaminants and a significant environmental phenomenon;</p> <p><b>C2.</b> investigate how different environmental factors can affect people's health and their lifestyle choices;</p> <p><b>C3.</b> demonstrate an understanding of the ways in which environmental factors can affect human health and how their impact can be reduced.</p>
Assessment for Learning	<p><b>Checkpoint (after the completion of Lesson 1):</b></p> <p>Students will collect information on sources of air pollution both inside and outside of the home by viewing an episode of <i>The Nature of Things</i>. Using the information collected, students will write a response to the statement: <i>Canadians are exposed to numerous pollutants on a daily basis. It is the government's responsibility to make sure that the air we breathe is clean and does not cause health problems.</i></p> <p><b>Checkpoint (at the end of Lesson 2):</b></p> <p>The project manager for each group will submit a design as well as a list of required materials (including plants) for the construction of the air biofilter. The teacher will review the proposed air biofilter design and requested materials and provide feedback and suggestions to the project manager. The project manager will take this information back to their group.</p> <p><b>Checkpoint (at the end of Lesson 3):</b></p> <p>The students must demonstrate their proficiency in the use of a compound microscope by being able to identify the main components; preparing a wet mount slide of an eyebrow hair and focussing the hair under the three different objective powers; and by creating a proper scientific scale drawing of an <i>euglena</i> and <i>paramecium</i> specimen.</p>

# Environmental Science, Grade 11, **SVN3E**

## Workplace Preparation

Suggested Lesson Sequence		Approx. Duration
Lesson 1	<p><b>Lesson Goal</b></p> <p>Students are introduced to the topic of air pollution by evaluating how their own daily activities may contribute to pollution. As well, students gather information on how pollutants are produced both inside and outside of the home by viewing <i>The Nature of Things</i> episode “Up Close &amp; Toxic!” Further, students will explore the role of the government in monitoring air quality and preventative measures recommended by Health Canada and Environment Canada. Students will also start to create a list of vocabulary terms related to human health and the environment.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ A Day in the Life of Me!</li> <li>➤ <i>Up Close &amp; Toxic!</i> video worksheet</li> <li>➤ Human Health &amp; the Environment Vocabulary</li> </ul>	3 classes
Lesson 2	<p><b>Lesson Goal</b></p> <p>The teacher will introduce the students to the design project of building and monitoring an air biofilter by helping the students to explore the design components of different biowalls/living walls/air biofilters (<i>Indoor Air Biofilter</i> Poster – University of Guelph; Biowall – Queen’s University; I2C – University of Toronto). The students must work as a group, take on a role in the group and decide on the design of their air biofilter and the materials needed. Once the materials have been collected, the students will build their model of an air biofilter and monitor it for the presence of microbes in the water and the health of the plants.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Assigning Roles in a Group</li> </ul>	4 classes
Lesson 3	<p><b>Lesson Goal</b></p> <p>The teacher will review or introduce the microscopy skills needed for the students to monitor the water in their air biofilter by: (i) explaining the components of a compound microscope; and (ii) demonstrating the proper technique of preparing a wet mount slide. The students will then demonstrate their understanding by: (i) identifying the main components of a compound microscope; (ii) preparing their own wet mount slide and using the microscope to focus on the specimen at each of the three objective powers; and (iii) creating a scale drawing of <i>euglena</i> and <i>paramecium</i> from prepared slides.</p>	1 class
Lesson 4	<p><b>Lesson Goal</b></p> <p>The students are responsible for monitoring and maintaining the functioning and effectiveness of their air biofilter. At the end of a reasonable amount of time, the students will communicate the design, construction, and monitoring phases of the project as well as making recommendations.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Air Biofilter Project – Peer Evaluation Form</li> <li>➤ Air Biofilter Project – Evaluation Rubric</li> </ul>	Open – based on time for monitoring and preparing final presentation

### **Suggested Resources**

#### *Teaching Content Literacy*

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

#### *Introduction to Air Quality*

- CBC's *The Nature of Things*. "Up Close & Toxic." 2009. CBC. 21 February 2009. < [http://www.cbc.ca/natureofthings/toxic\\_printable.html](http://www.cbc.ca/natureofthings/toxic_printable.html) > {the episode will have to be obtained through your board's media library}
- Health Canada. "Air Quality – Environmental and Workplace Health." 18 April 2008. Public Works and Government Services Canada. 21 February 2009. < <http://www.hc-sc.gc.ca/ewh-semt/air/index-eng.php> >
- Environment Canada. "Clean Air Online." 20 November 2008. Public Works and Government Services Canada. 21 February 2009. < [http://www.ec.gc.ca/cleanair-airpur/Home-WS8C3F7D55-0\\_En.htm](http://www.ec.gc.ca/cleanair-airpur/Home-WS8C3F7D55-0_En.htm) >
- U.S. Environmental Protection Agency. "Sick Building Syndrome." 20 February 2008. EPA. 21 February 2009. < <http://www.epa.gov/iaq/pubs/sbs.html> >

#### *Planning the Air Bio-Filter Construction*

- Darlington, Alan B., "Indoor Air Biofilters." nd. University of Guelph. 21 February 2009. < <http://www.ces.uoguelph.ca/posters/biofilter.pdf> >
- Integrated Learning Centre, Faculty of Applied Science, Queens University. "Biowall." 2006. Queens University. 21 February 2009. < [http://livebuilding.queensu.ca/green\\_features/biowall](http://livebuilding.queensu.ca/green_features/biowall) >
- Centre for Information Systems in Infrastructure & Construction, Department of Civil Engineering, University of Toronto. "Facility: About ic2." 22 May 2008. University of Toronto. 21 February 2009. < <http://i2c.engineering.utoronto.ca/I2C/About.aspx> >

#### *Developing Microscopy Skills*

- Gajewski, Stan, et al. *Science Essentials 10*. Toronto: MHR, 2007.
- Grace, Eric, et. al. *SCIENCEPOWER 10*. Toronto: McGraw-Hill Ryerson, 2001.

Create a timeline showing all of your daily activities from the time you get out of bed in the morning until you go to bed at night.

## ACTIVITY

✓/X

- If you think “yes”, then place a “✓” in the left-hand column next to the listed activity.
- If you think “no”, then place an “X” in the left-hand column next to the listed activity.

## Inside the Home

## Outside the Home

- •  
•  
•  
•  
•

- [illegible]

### Up Close & Toxic!

You will be watching the video titled *Up Close & Toxic!* The video presents a typical day in the life of a Toronto family. As the day progresses members are exposed to various toxins in the air in different locations. As you watch the video, make note of the various sources of pollutants in the various locations.

Inside the Home	
<b>Kitchen:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>Living Room:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>
<b>Bathroom:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>Basement:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>
Outside the Home	
<b>Vehicle:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>Office:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>
<b>School:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>	<b>Other:</b> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>

What suggestions does David Suzuki make to help reduce the amount of pollutants from entering your home?

- 1.
- 2.
- 3.
- 4.

Now share your answers with someone else in the class. Add any items to your list that they got and you didn't.

Write a response to the following statement: *Canadians are exposed to numerous pollutants on a daily basis. It is the government's responsibility to make sure that the air we breathe is clean and does not cause health problems.* Use the template below to help you formulate your response.

Opinion response	Points Supporting My Opinion
	•
	•
	•

I think that \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

I think this way because \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Other people might think \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

I don't agree because \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## **Human Health & the Environment**

### **Vocabulary Terms**

The chart below is to help you in creating your own glossary of new vocabulary terms that you may encounter while learning about human health and the environment. The words listed are ones you will encounter the most and are important for you to understand.

<b>Term</b>	<b>What I Think the Term Means</b>	<b>Actual Definition of the Term</b>
VOC's (volatile organic compounds)		
Formaldehyde		
Smog		
Environmental contaminants		
Toluene		
Aerosols		
Air quality index		

Inhalation		
Ingestion		
Absorption		
Ozone		
Toxin		
Pollutants		
Carbon Monoxide		
Radon gas		
Pathogens		

### **Assigning Roles in a Group\***

Students tend to take more ownership and responsibility when working on a group task if they have a specific role and know what their responsibilities include. The following is a list of **6** different roles that could be assigned during a group task along with the responsibility of each role. For smaller groups, choose the roles that are most appropriate for the task.

**Production Manager will:**

- Oversee the project
- Ensure everyone does his or her job
- Manage the process
- Keep track of the project
- Communicate with the teacher when group needs direction

**Information Manager will:**

- Ensure accuracy of materials
- Ensure quality of the product
- Listen and make sure ideas are clear
- Follow written directions

**Resource Manager will:**

- Gather and manage materials
- Properly store materials
- Arrange and acquire materials and make sure materials are available

**Personnel Manager will:**

- Manage people and build morale
- Encourage team members
- Help resolve conflicts
- Help solve problems
- Monitor effort and productivity

**Technology Manager will:**

- Assist with technology aspects
- Help with computer needs
- Resources from internet
- Help with presentation techniques

**Time Manager will:**

- Manage deadlines
- Help team keep on track
- Communicate with production manager
- Negotiate time needed

\*Adapted from *Differentiated Instructional Strategies* by Gayle H. Gregory and Carolyn Chapman

### Air Biofilter Project Peer Evaluation Form

<b>Criteria for marking</b>  Place the name of each group member, including your own, in the empty spaces to the right. <ul style="list-style-type: none"> <li>evaluate each member of your group by circling either <b>Yes</b> or <b>No</b> in response to the question stated</li> <li>circling <b>Yes</b> indicates that the group member demonstrated that trait most of the time</li> <li>circling <b>No</b> indicates that the group member rarely or never demonstrated the trait</li> </ul>	Names (put a star beside your own name)				
Does this person arrive prepared to work?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Does this person bring ideas into group discussions and actively take part in group brainstorming activities?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Does this person complete their individual tasks on time?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Does this person work effectively with others; taking into consideration others ideas/views and compromising?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Does this person show initiative to go above and beyond to do their best for the group (getting other resources, etc)?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Is this person reliable to work without needing prompting to stay on task?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Did this person take part in organizing the group, as well as keeping their own tasks organized?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
Is this person someone you would work with on another project based on their efforts for this one?	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>	<b>Yes</b> <b>No</b>
<b>Based on your evaluation, give your peers and yourself an overall mark out of 10 for their effort on this task.</b>					

Comment on how effective your group was at completing the assigned task.

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# Environmental Science, Grade 11, **SVN3E** Workplace Preparation

## Air BioFilter Project – Evaluation Rubric

Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
<b>Knowledge/Understanding</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>demonstrates limited knowledge while completing and monitoring air bio-filter</li> <li>demonstrates limited understanding of proper recording and reporting of results from an air bio-filter investigation</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates some knowledge while completing and monitoring air bio-filter</li> <li>demonstrates some understanding of proper recording and reporting of results from an air bio-filter investigation</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates considerable knowledge while completing and monitoring air bio-filter</li> <li>demonstrates considerable understanding of proper recording and reporting of results from an air bio-filter investigation</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates thorough knowledge while completing and monitoring air bio-filter</li> <li>demonstrates thorough understanding of proper recording and reporting of results from an air bio-filter investigation</li> </ul>
<b>Thinking/Inquiry/Problem Solving</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>identifies a few of the factors that affect air quality in Canada</li> <li>analysis data from an air bio-filter investigation with limited effectiveness</li> <li>interprets the data from the air bio-filter investigation with limited effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies some of the factors that affect air quality in Canada</li> <li>analysis data from an air bio-filter investigation with some effectiveness</li> <li>interprets the data from the air bio-filter investigation with some effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies most of the factors that affect air quality in Canada</li> <li>analysis data from an air bio-filter investigation with considerable effectiveness</li> <li>interprets the data from the air bio-filter investigation with considerable effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies all of the factors that affect air quality in Canada</li> <li>analysis data from an air bio-filter investigation with a high degree of effectiveness</li> <li>interprets the data from the air bio-filter investigation with a high degree of effectiveness</li> </ul>
<b>Communication</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>expresses information in presentation with limited clarity</li> <li>creates a presentation summarizing the results of the air bio-filter investigation with a limited sense of purpose</li> <li>demonstrates limited logic when creating a presentation</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in presentation with some clarity</li> <li>creates a presentation summarizing the results of the air bio-filter investigation with some sense of purpose</li> <li>demonstrates some logic when creating a presentation</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in presentation with considerable clarity</li> <li>creates a presentation summarizing the results of the air bio-filter investigation with considerable effectiveness</li> <li>demonstrates considerable logic when creating a presentation</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in presentation with a high degree of clarity</li> <li>creates a presentation summarizing the results of the air bio-filter investigation with a high degree of purpose</li> <li>demonstrates thorough logic when creating a presentation</li> </ul>

# Environmental Science, Grade 11, **SVN3E** Workplace Preparation

<b>Applications</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>transfers key aspects of air quality regulations to inform the general public with limited detail</li> <li>makes connection between human health and the environment with limited comprehension</li> </ul>	<ul style="list-style-type: none"> <li>transfers key aspects of air quality regulations to inform the general public with some detail</li> <li>makes connection between human health and the environment with some comprehension</li> </ul>	<ul style="list-style-type: none"> <li>transfers key aspects of air quality regulations to inform the general public with considerable detail</li> <li>makes connection between human health and the environment with considerable comprehension</li> </ul>	<ul style="list-style-type: none"> <li>transfers key aspects of air quality regulations to inform the general public with a high degree of detail</li> <li>makes connection between human health and the environment with a high degree of comprehension</li> </ul>

NOTES:

<b>Case Study: <i>The Poisoning of Grassy Narrows</i></b>	
<b>Assessment of Learning:</b>	<p><b>Goal</b></p> <p>Students will gather information from the viewing of video clips and listening to audio clips and use that information to write an opinion response to the statement: <i>The Ontario Government is guilty of environmental racism and neglect in their treatment of the natives on the Grassy Narrows reserve.</i></p> <p><b>Standards for Student Success</b></p> <p>Students will write an opinion response that includes the following elements:</p> <ul style="list-style-type: none"> <li>➤ a statement of their opinion</li> <li>➤ evidence, facts, examples or reasons supporting their opinion</li> <li>➤ awareness of opposing views and reasons against those views</li> </ul> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>C1.</b> analyse the effects on human health of environmental contaminants and a significant environmental phenomenon;</p> <p><b>C3.</b> demonstrate an understanding of the ways in which environmental factors can affect human health and how their impact can be reduced.</p>
<b>Assessment for Learning</b>	<p><b>Checkpoint (after the completion of Lesson 1):</b></p> <p>Using the strategy of “Exit Slip”, “Concept Mapping”, or “Reciprocal Teaching” students will communicate their understanding of bioaccumulation in an ecosystem and the effect of contaminant concentration on organism in an ecosystem as one moves from producer to top consumer in a food chain/web.</p> <p><b>Checkpoint (after the completion of Lesson 2):</b></p> <p>By analyzing audio and video clips, students will collect evidence, facts, examples and statistics in order to prepare to write an opinion response to a statement given.</p> <p><b>Checkpoint (after the completion of Lesson 3):</b></p> <p>The students will demonstrate their understanding of the effects of various contaminants and likely modes of exposure to such contaminants in Ontario.</p>

# Environmental Science, Grade 11, **SVN3E**

## Workplace Preparation

Suggested Lesson Sequence		Approx. Duration
Lesson 1	<p><b>Lesson Goal</b></p> <p>Students are prepared for the case study through a teacher-lead review of key ecological concepts of relevance (<i>energy transfer in ecosystems, food chains, food webs, bioaccumulation</i>). Further, students are presented with the key vocabulary terms and explore their meaning through the use of an anticipation guide (see worksheet attached); list-pair-group; or a word wall.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Human Impact on the Environment – Vocabulary Terms</li> </ul>	3 classes
Lesson 2	<p><b>Lesson Goal</b></p> <p>Students learn about the contamination of the English-Wabigoon river system by the pulp and paper mill located in Dryden, Ontario. They will gather information from CBC archived video and audio clips to help them form a response to the statement: <i>The Ontario government is guilty of environmental racism and neglect in their treatment of the natives on the Grassy Narrows reserve.</i></p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Case Study – Mercury Rising: The Poisoning of Grassy Narrows</li> <li>➤ Opinion Response – Mercury Rising: The Poisoning of Grassy Narrows</li> </ul>	3 classes
Lesson 3	<p><b>Lesson Goal</b></p> <p>Students will use the Ministry of the Environment's <i>2007 – 2008 Guide to Eating Ontario Sport Fish</i> to investigate the safe consumption of three different species of fish from a lake/river in Ontario. Using the information from the guide, the students will research possible expose routes and health effects from different contaminants found in Ontario sport fish.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ What Fish are Safe to Eat?</li> <li>➤ Effects of Contaminants</li> </ul> <p><b>Planning Notes</b></p> <ul style="list-style-type: none"> <li>• Printing off the fact sheets for the 8 different contaminants (<i>mercury, PCB's, Mirex, dioxans, furans, phenols, benzene &amp; PAH's</i>) from the Agency for Toxic Substances and Disease Registry's website (<a href="http://www.atsdr.cdc.gov">www.atsdr.cdc.gov</a>) would expedite the activity, if so desired.</li> <li>• Although the opinion response is introduced to the students at the end of Lesson 2, it should not be collected until after the completion of Lesson 3 so that students have the opportunity of incorporating some of the concepts they will have learnt from the contaminants in Ontario sport fish activities.</li> </ul>	3 classes

### **Suggested Resources**

#### *Teaching Content Literacy*

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

#### *Introduction to Human Impact on the Environment*

- Cambridge Educational Production. *Environmental Issues and Human Impact* (DVD). McIntyre Media Inc. 2006.  
**Synopsis:** This DVD explores environmental concerns facing planet Earth and the degradation humans have caused. Air and water pollution, the effects of pollution on health and the environment, deforestation and loss of wetlands, ozone depletion and global warming, and the negative impact of agriculture, construction, and recreation/tourism are discussed.

#### *Review of Ecology Concepts and Bioamplification*

- Grace, Eric, et. al. *SCIENCEPOWER 10*. Toronto: McGraw-Hill Ryerson, 2001.
- Gibb, Thomas. *Science 10: Concepts & Connections*. Toronto: Nelson Publishing, 2002.
- Ritter, Bob, et. al. *Science 10*. Toronto: Nelson Publishing, 2000.

#### *Case Study - Mercury Rising: The Poisoning of Grassy Narrows*

- CBC Digital Archives. "Mercury Rising: The Poisoning of Grassy Narrows." nd. CBC. 21 February 2009.  
< <http://archives.cbc.ca/environment/pollution/topics/1178/> >

#### *Pollutants in Ontario Fish*

- Ontario Ministry of the Environment. "The 2007 – 2008 Guide to Eating Ontario Sport Fish." 21 October 2008. Queen's Printer for Ontario. 21 February 2009. < <http://www.ene.gov.on.ca/envision/guide/> >
- Agency for Toxic Substances & Disease Registry. "Agency for Toxic Substances and Disease Registry." 18 February 2009. Agency for Toxic Substances and Disease Registry. 21 February 2009.  
< <http://www.atsdr.cdc.gov/> >

**Human Impact on the Environment**  
Vocabulary Terms

The chart below is to help you in creating your own glossary of new vocabulary terms that you may encounter while learning about human impact on the environment. The words listed are ones you will encounter most often and are important for you to understand.

<b>Term</b>	<b>What I Think the Term Means</b>	<b>Actual Definition of the Term</b>
Ecosystem		
Food chain		
Producer		
Consumer		
Herbivore		
Carnivore		
Decomposers		

Causes		
Symptoms		
Treatments		
Toxins		
Bioamplification		
Concentration		
Acute		
Chronic		
Pathogens		

Case Study - **Mercury Rising: The Poisoning of Grassy Narrows**

**Gathering Information**

- As you watch the video clip *The Water's No Good* answer the following questions.

1. Where do the events take place? \_\_\_\_\_

2. What is the problem with the water? \_\_\_\_\_  
\_\_\_\_\_

3. When was this taking place? \_\_\_\_\_

4. Why are there toxins in the water? \_\_\_\_\_  
\_\_\_\_\_

5. Who is this happening to? \_\_\_\_\_

6. How are people being affected?  
\_\_\_\_\_  
\_\_\_\_\_

**Reflection #1**

In the box below, write, in sentences, how this video made you feel. Use specific parts of the video to describe your thoughts.

Case Study - **Mercury Rising: The Poisoning of Grassy Narrows**

**Minamata Disease**

- As you listen to clip #2 *A Clear and Present Danger* record information below on the causes, symptoms (both acute and severe) and testing for Minamata disease.

Causes	Acute Symptoms	Severe Symptoms	Testing

**Final Reflection**

- Watch clip #10 *Still Ill* and after viewing complete the final reflection.

In the box below write how the video and audio program changed your views on industries, the government, and how aboriginal communities are treated by both.

--

### What Fish are Safe to Eat?

1. In the table below, list a lake in the province of Ontario to which you have been. Now, use the Ontario Ministry of the Environment's *2007 – 2008 Guide to Eating Ontario Sport Fish* to find out what page in the guide the lake appears.

<b>Lake</b>	
<b>Page Number</b>	

2. Name a fish that is found in that lake.

<b>Name of Fish</b>	
---------------------	--

3. Using the section in the middle of the guide, look up the fish listed above. Write down the features of that fish in the table below.

<b>Features</b>

4. List the number of meals per month that the **general population** could eat for each specific length of the fish selected in the table below.

<b>Length of Fish (cm)</b>	<b># of Meals/Month</b>

5. At the end of the name of a fish there is a list of numbers written in subscript. Write these numbers down and then use page 8 of the guide to determine what contaminants are present in that fish.

<b>Subscript Number(s)</b>	<b>Contaminants</b>

**You will now need to complete the same steps as above for two (2) more lakes.**

1. In the table below, list a lake in the province of Ontario to which you have been. Now, use the Ontario Ministry of the Environment's *2007 – 2008 Guide to Eating Ontario Sport Fish* to find out what page in the guide the lake appears.

<b>Lake</b>	
<b>Page Number</b>	

2. Name a fish that is found in that lake.

<b>Name of Fish</b>	
---------------------	--

3. Using the section in the middle of the guide, look up the fish listed above. Write down the features of that fish in the table below.

<b>Features</b>

4. List the number of meals per month that the **general population** could eat for each specific length of the fish selected in the table below.

<b>Length of Fish (cm)</b>	<b># of Meals/Month</b>

5. At the end of the name of a fish there is a list of numbers written in subscript. Write these numbers down and then use page 8 of the guide to determine what contaminants are present in that fish.

<b>Subscript Number(s)</b>	<b>Contaminants</b>

1. In the table below, list a lake in the province of Ontario to which you have been. Now, use the Ontario Ministry of the Environment's *2007 – 2008 Guide to Eating Ontario Sport Fish* to find out what page in the guide the lake appears.

<b>Lake</b>	
<b>Page Number</b>	

2. Name a fish that is found in that lake.

<b>Name of Fish</b>	
---------------------	--

3. Using the section in the middle of the guide, look up the fish listed above. Write down the features of that fish in the table below.

<b>Features</b>

4. List the number of meals per month that the **general population** could eat for each specific length of the fish selected in the table below.

<b>Length of Fish (cm)</b>	<b># of Meals/Month</b>

5. At the end of the name of a fish there is a list of numbers written in subscript. Write these numbers down and then use page 8 of the guide to determine what contaminants are present in that fish.

<b>Subscript Number(s)</b>	<b>Contaminants</b>

Effects of Contaminants

Now that you have investigate potential contaminants in Ontario sports fish, you will choose 3 of the contaminants listed below and find out how you might be exposed to the contaminant and how the contaminant affects your health. Share your findings with fellow classmates so that you complete the entire table.

Potential Contaminant	How might I be exposed to the contaminant?	How can the contaminant affect my health?
Mercury	<div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div></div>
PCB`s (polychlorinated bisphenols)	<div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div></div>
Mirex	<div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div></div>
Dioxans	<div><div></div><div></div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div><div></div><div></div></div>

Environmental Science, Grade 11, SVN3E

Workplace Preparation

Potential Contaminant	How might I be exposed to the contaminant?	How can the contaminant affect my health?
Furans	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>
Phenols	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>
Benzenes	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>
PAH's (polyaromatic hydrocarbons)	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li></li> <li></li> </ul>

**Opinion Response** - Mercury Rising: The Poisoning of Grassy Narrows

**Topic or issue:**

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---

**My opinion** or position concerning the issue:

[yes/agree no/disagree]

---

---

**Support:** (a)

(b)

(c)

**Opposing views:** other people might think that

---

---

---

I do not agree with their views for the following reasons:

(a)

(b)

(c)

Now organize the above information into an opinion response.

[illegible]

<b>Goal</b>	<p><b>To persuade a local Member of Parliament about the need for the government to monitor closely what industrial production plants release into an aquatic environment</b></p> <p>While pursuing this goal, students will:</p> <ul style="list-style-type: none"><li>• Deepen their understanding of the role that government plays in monitoring water quality and the need for such monitoring</li><li>• Develop an understanding of the connection between human activity, human health and the environment</li><li>• Learn about persuasive communication techniques</li></ul>
<b>Role</b>	<p>The student will assume the role of a citizen who is concerned about the effluent that is being released by a pulp and paper mill into an aquatic environment</p>
<b>Audience</b>	<p>The audience is a local Member of Parliament in an area where a pulp and paper mill is located.</p>
<b>Scenario</b>	<p>The pulp and paper mill is located in a town which is situated along a river. The pulp and paper mill is the largest employer in the town and releases effluent into the river. Located down river from the town is a First Nations reserve. The First Nations people fish from the river.</p>
<b>Product and/or Performance</b>	<p>Students will:</p> <ul style="list-style-type: none"><li>• Keep a folder of their work (worksheets, research notes) for assessment purposes</li><li>• Submit a copy of the letter written to the local Member of Parliament. The letter must be formal and respectful.</li><li>• The letter must contain the following elements:<ul style="list-style-type: none"><li>- the contact information</li><li>- an introductory paragraph, introducing themselves, who they are and why they are writing</li><li>- at least 3 paragraphs of evidence/support for their position.</li><li>- an ending paragraph</li><li>- an appropriate closing</li></ul></li></ul>

# Environmental Science, Grade 11, SVN3E

## Workplace Preparation

### Case Study: Toxic Work! It's all in your head.

Assessment of Learning:

#### Goal

Students will gather information about the claims of brain poisoning by workers at the Weyerhaeuser pulp and paper mill in Dryden, Ontario. The students will use this information to recommend a course of action that could be taken to prevent such illnesses from occurring in the workplace.

#### Standards for Student Success

Students will :

- complete a Case Study worksheet to investigate how industries have a responsibility to protect both communities and their own employees

#### Overall Expectations Evaluated

**A1.** demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);

**A2.** identify and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields;

**F1.** assess workplace situations with respect to safety and environmental issues, and propose a course of action to address unsafe working conditions;

**F2.** investigate a variety of safe and environmentally responsible workplace practices;

**F3.** demonstrate an understanding of general workplace safety procedures and environmentally responsible practices.

Assessment for Learning

#### Checkpoint (after the completion of Lesson1):

Students will review the concepts of Health and Safety in the Workplace and will complete an online assignment from the Workplace Health and Safety website.

#### Checkpoint (after the completion of Lesson 3):

Students will demonstrate an understanding of a specific workplace accident at the paper mill in Dryden, Ontario and the importance of health and safety standards in industry by completing a Dryden Case Study worksheet.

#### Checkpoint (after the completion of Lesson 4):

Students will complete a reflective journal entry on a course of action to prevent injuries from occurring in the workplace, placing particular emphasis on the responsibilities of both employer and employees in their role to ensure safe work environments.

# Environmental Science, Grade 11, **SVN3E** Workplace Preparation

Suggested Lesson Sequence		Approx. Duration
Lesson 1	<p><b>Lesson Goal</b></p> <p>In the computer lab, students will complete the online Health and Safety activity in order to review safe practice in the workplace (e.g. Personal Protective Equipment, reporting injuries and/or faulty equipment, WHMIS symbols etc.).</p> <p><b>Worksheet</b></p> <ul style="list-style-type: none"> <li>➤ Workplace Health and Safety</li> </ul>	1 class
Lesson 2	<p><b>Lesson Goal</b></p> <p>Students are to brainstorm different jobs where employees may be exposed to dangerous chemicals, gases, or hazardous waste. The teacher will lead a class discussion on whether any students know of or have heard of anyone who has been exposed to dangerous substances at work that have caused injury (newspaper articles could also be used to drum up discussion). Review definitions of the terms “chronic”, “acute”, “symptom” and “treatment”, which were terms visited in the “Grassy Narrows” Case Study. Introduce the new terms “effluent” and “air quality”.</p>	1 class
Lesson 3	<p><b>Lesson Goal</b></p> <p>In the computer lab, students are to go to the following website: <a href="http://www.cbc.ca/thunderbay">www.cbc.ca/thunderbay</a>. They will then need to find the “Features” column and bring up “Toxic Work? It’s All in Your Head”. Using this website, the class will look at the construction of the recovery boiler at the paper mill in Dryden, Ontario and how workers were exposed to gas fumes that caused serious injuries. Once all components have been completed, the class will listen to the audio component of the case study together and discuss the mishaps at Dryden and their opinions on the issue.</p> <p><b>Worksheet</b></p> <ul style="list-style-type: none"> <li>➤ Toxic Work? It’s All in Your Head</li> </ul>	2 classes
Lesson 4	<p><b>Lesson Goal</b></p> <p>Students will complete a reflective journal entry on the course of action that could be taken to prevent such illnesses from occurring in the workplace, using specific information from their Health and Safety activity and the “Toxic Work? It’s All in Your Head” activity.</p>	1 class

## Suggested Resources

### Teaching Content Literacy

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

*Health and Safety in the Workplace*

- WSIB. "Health & Safety 101." nd. Workplace Safety & Insurance Board of Ontario. 21 February 2008. < [www.hs101.ca](http://www.hs101.ca) >

*Case Study: Toxic Work! It's all in your head.*

- CBC Thunder Bay – Features. "Toxic Work! It's All In Your Head." 2009. CBC. 21 February 2009. < [http://www.cbc.ca/thunderbay/features/brain-poisoning/index.html?dataPath=/photogallery/regions/thunderbay/gallery\\_339/xml/gallery\\_339.xml](http://www.cbc.ca/thunderbay/features/brain-poisoning/index.html?dataPath=/photogallery/regions/thunderbay/gallery_339/xml/gallery_339.xml) >

## **WORKPLACE HEALTH AND SAFETY**

- Use [www.hs101.ca](http://www.hs101.ca) as the website for this assignment.
- Click on "English".
- Click on "Launch high speed".

### **Section 1: Safety Matters**

(click on this tab at the top of the webpage)

1. Under "Introduction", what 3 things will you learn about in this section:
  - a)
  - b)
  - c)
2. Under "Be Aware", watch the video on Marco.
3. Under "Health and Safety Laws", explain the purpose of the Ontario government's laws on health and safety.
4. a) What does OSHA stand for?
  - b) Who is covered by the OSHA?
  - c) Who is covered by the Canada Labour Code?
  - d) Who is NOT covered?

### **Section 2: Safety Roles**

(click on this tab at the top of the webpage)

1. Under "Employer Role" and by clicking on the picture on the right-hand side, list the 5 employer responsibilities:
  - a)
  - b)
  - c)
  - d)
  - e)

2. Under "Your Role" and by clicking on the picture on the right-hand side, list your 5 responsibilities as a worker:

- a)
- b)
- c)
- d)
- e)

3. Under "Your Rights", name your 3 rights as a worker:

- a)
- b)
- c)

### **Section 3: Work Hazards**

(click on this tab at the top of the webpage)

1. Read the information and complete the online exercises under "Recognizing Hazards".

2. Under "WHMIS", what are the two most dangerous hazards in the workplace?

3. Under "Summary", name the 4 main types of hazards (and the possible fifth):

- a)
- b)
- c)
- d)

possible fifth hazard –

4. What are **acute injuries**?

5. What are **chronic injuries**?

**Section 4: Staying Safe**

(click on this tab at the top of the webpage)

1. Under "Controlling Hazards", read through the ways to control the 4 types of workplace hazards (physical, chemical, ergonomic, biological).

2. a) Under "PPE", explain what the letters PPE stand for:

b) Give 5 different examples of PPE:

- 
- 
- 
- 
- 

3. Under "Reporting Injuries", what 3 things must YOU do if you get hurt?

- a)
- b)
- c)

## Toxic Work? It's all in Your Head

### Summarizing Thumbnails

Complete each *Thumbnail* section by filling in the blanks. Once this is complete have your answers marked before beginning the Audio Case Study section.

#### Thumbnail #1: Blotting out the Sun

1. Where is this taking place? \_\_\_\_\_
2. Where did the workers come from?  
\_\_\_\_\_
3. When did this occur? \_\_\_\_\_
4. Who is given as an example of a victim? \_\_\_\_\_

#### Thumbnail #2: Revealing a Health Hazard

1. What does diagnosis mean?  
\_\_\_\_\_
2. Who was the physician in charge of diagnosing the workers?  
\_\_\_\_\_
3. What was the diagnosis?  
\_\_\_\_\_

#### Thumbnail #3: A Shroud of Emissions

1. How high is the recovery boiler? \_\_\_\_\_
2. How much did it cost? \_\_\_\_\_
3. Which direction is the prevailing wind? \_\_\_\_\_
4. What effect do the winds have on the plume of smoke (draw it below)

Thumbnail #4: 'Like a Pair of God's Hands'

1. What was Terry Melnick's job? \_\_\_\_\_
2. What was he exposed to? \_\_\_\_\_
3. What did he say the plume caused in the people exposed to it?  
\_\_\_\_\_
4. How did this affect Terry's ability to work?  
\_\_\_\_\_

Thumbnail #5: Massive Production

1. How many tonnes are produced each year in the mill of;
  - a. White paper: \_\_\_\_\_
  - b. Bleached northern softwood & hardwood cellulose fibers:  
\_\_\_\_\_

Thumbnail #6: Weyerhaeuser's Reaction

1. How many air quality tests did Weyerhaeuser say were conducted during the construction of the new recovery boiler? \_\_\_\_\_
  2. What were the results?  
\_\_\_\_\_
  3. How much effluent is processed each day by the mill? \_\_\_\_\_.  
What is this treated to control? \_\_\_\_\_
- Bring your booklet to the teacher to be marked before beginning the next section.

**Audio Case Study**

Part 1:

1. What were the symptoms of the workers?  
\_\_\_\_\_
2. How did the workers know something was wrong?  
\_\_\_\_\_
3. What safety equipment was said to be used?  
\_\_\_\_\_
4. What made the men sick? \_\_\_\_\_
5. Why did the mill have to build the boiler?  
\_\_\_\_\_

6. Why did Weyerhaeuser still put the recovery boiler there?

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7. Do you trust the project manager Norm Bush? Why/Why not?

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Part 2:

1. How bad did workers say things got?

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2. What did Dr. McDahmers notice about the workers?

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What did he say the symptoms were?

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3. What did the company do to help the situation?

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4. What were the workers given for protection?

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5. What do you think they mean about a chemical cocktail?

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6. After hearing this clip write a reflection on who you believe more from this case study, the Workers, the Company, or the Ministry of Labour. Give an explanation for why you think this way.

### Case Study: *Storm that Drowned a City*

Assessment of Learning:	<p><b>Goal</b></p> <p>After analyzing the events leading up to, during and after Hurricane Katrina, students will create a disaster preparedness brochure that is appropriate for the area in which they live.</p> <p><b>Standards for Student Success</b></p> <p>Students will create a brochure/pamphlet/information booklet/public service announcement that informs the public about:</p> <ul style="list-style-type: none"> <li>➤ what is needed in the event of a natural disaster</li> <li>➤ what to do during the disaster</li> <li>➤ what to do in the days/weeks after the disaster</li> <li>➤ other places to obtain information</li> </ul> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>A2.</b> identify and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields;</p> <p><b>C1.</b> analyse the effects on human health of environmental contaminants and a significant environmental phenomenon;</p> <p><b>C2.</b> investigate how different environmental factors can affect people's health and their lifestyle choices.</p>
Assessment for Learning	<p><b>Checkpoint (after the completion of Lesson 1):</b></p> <p>Students will summarize their observations from the activity that investigated the effect of mesh-size on a steam plume and demonstrate their understanding of how this activity relates to the formation and severity of a hurricane.</p> <p><b>Checkpoint (after the completion of Lesson 2):</b></p> <p>By analyzing video clips, students will research information about the Gulf Coast region of the United States and the consequence to human health after a natural disaster.</p>

Suggested Lesson Sequence		Approx. Duration
Lesson 1	<p><b>Lesson Goal</b></p> <p>Students' prior knowledge of hurricanes is activated through an exploration of the interactive program <i>Anatomy of Katrina</i> (<a href="http://www.pbs.org/wgbh/nova/orleans/anatomy.html">http://www.pbs.org/wgbh/nova/orleans/anatomy.html</a>) and through a teacher-lead activity on wetlands and hurricane severity. Further, students are presented with the key vocabulary terms and explore their meaning through the use of an anticipation guide (see worksheet attached); list-pair-group; or a word wall.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Human Health and the Environment – Vocabulary Terms (Hurricane Katrina)</li> <li>➤ Activity: Wetlands and Hurricanes</li> </ul>	2 – 3 classes
Lesson 2	<p><b>Lesson Goal</b></p> <p>The teacher leads a class discussion in which students recall what they remember about Hurricane Katrina. The discussion is followed by the students viewing the NOVA episode <i>Storm That Drowned a City</i> (<a href="http://www.pbs.org/wgbh/nova/orleans/program.html">http://www.pbs.org/wgbh/nova/orleans/program.html</a>). The students will research information about the Gulf Coast region of the United States as well as dangers to human health after a natural disaster.</p> <p><b>Worksheets</b></p> <ul style="list-style-type: none"> <li>➤ Gulf Coast Region Scavenger Hunt</li> <li>➤ Dangers to Human Health after Natural Disasters such as Hurricane Katrina</li> </ul> <p><b>Planning Notes</b></p> <ul style="list-style-type: none"> <li>• PBS has the episode divided into 6 chapters. As such, each class can be divided into a sequence of showing two chapters, with a discussion after each, followed by time in the computer lab to complete the worksheets.</li> <li>• The students would use the information gathered for the worksheets as well as from the episode chapters to complete the project task.</li> </ul>	3 classes

### Suggested Resources

#### Teaching Content Literacy

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

*Case Study – Storm That Drowned a City*

- NOVA Science Programming On Air and Online. “Storm That Drowned a City.” nd. PBS. 21 February 2009.  
< <http://www.pbs.org/wgbh/nova/orleans/> >
- Wikipedia. “Gulf Coast of the United States.” 29 January 2009. Wikimedia Foundation Inc. 21 February 2009.  
< [http://en.wikipedia.org/wiki/Gulf\\_Coast\\_of\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Gulf_Coast_of_the_United_States) >
- National Geographic. “Gulf Wracked by Katrina’s Latest Legacy – Disease, Poisons, Mold.” 30 September 2005. National Geographic Society. 21 February 2009.  
[http://news.nationalgeographic.com/news/2005/09/0930\\_050930\\_katrina\\_health.html](http://news.nationalgeographic.com/news/2005/09/0930_050930_katrina_health.html)
- Center for Disease Control and Prevention. “Hurricane and Flood Recovery.” 2 July 2008. CDC Emergency Communication System. 21 February 2009.  
< <http://www.bt.cdc.gov/disasters/hurricanes/recovery.asp> >
- *Scienceworld* Article
  - “I Want This Job – Disaster Epidemiologist.” December 8, 2008.

**Human Health and the Environment**  
Vocabulary Terms (Hurricane Katrina)

The chart below is to help you in creating your own glossary of new vocabulary terms that you may encounter while learning about human health and the environment. The words listed are ones you will encounter most often and are important for you to understand.

<b>Term</b>	<b>What I Think the Term Means</b>	<b>Actual Definition of the Term</b>
Hurricane		
Condensation		
Wetlands		
Levee		
Canal		
Estuaries		
Sediment		
Industries		
Sea level		

### ACTIVITY: **Wetlands and Hurricanes**

In this activity, you will examine how wetlands can deprive a hurricane of some of the warm, moist air that supplies its energy. The steam plume represents a \_\_\_\_\_ and the different types of materials represent \_\_\_\_\_. You will record what happens to the plume of steam when different materials are placed in its path.

#### **MATERIALS**

- steam kettle with spout
- protective gloves (such as oven mitts or rubber gloves)
- Hot plate or equivalent heat source
- materials with different mesh sizes (window screen, cheesecloth, facial tissue, paper towel, cotton cloth, diaper, flannel)

#### **PROCEDURE**

Observe the steam plume coming out of the kettle's spout. What does the plume resemble? Describe the plume in the space below.

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#### **PREDICTIONS**

In the chart below predict how you think each material used will affect the steam plume when the material is placed over the kettle's spout.

Material	Affect
Window screen	
Nylon	
Cotton cloth	
Diaper	

## OBSERVATIONS

As you observe each material being put over the kettle's spout, record how each affects the steam plume.

Material	Affect
Window screen	
Nylon	
Cotton cloth	
Diaper	

## DISCUSSION QUESTIONS

1. What kind of wetlands do the coarse-meshed materials represent? (Circle the correct answer)

DENSE

SPARSE

2. What kind of wetlands do the fine-meshed materials represent? (Circle the correct answer)

DENSE

SPARSE

3. Why did the fine-meshed materials weaken the steam plume?

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4. How do healthy wetlands help protect a coastal area from a hurricane?

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### **Gulf Coast Region Scavenger Hunt**

Go to the following website: [http://en.wikipedia.org/wiki/Gulf\\_Coast\\_of\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Gulf_Coast_of_the_United_States) and answer the following questions.

1. What five (5) states make up the Gulf Coast Region of the U.S.?

1.	2.
3.	4.
5.	

2. In the "Contents" box click on the link "3.1 Metropolitan areas". List five (5) major coastal cities in the Gulf Coast Region.

1.	2.
3.	4.
5.	

3. List the major bodies of water in the coastal areas of Louisiana, Mississippi, and Alabama. In order to do this, you need to click on the above state names and go to the map located in the geography section.


4. Find the subtitle "Economic activities". What are the five (5) major industries in the Gulf Coast Region?

1.	2.
3.	4.
5.	

5. TYPE "Drainage in New Orleans" in the Wikipedia site's SEARCH engine and use the information found there for the following question. What two (2) systems are in place to keep a city such as New Orleans from flooding?

1.	2.
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6. TYPE "Hurricane Katrina" in the Wikipedia search engine and use the information found there under the section "Economic Effects" to answer the following questions.

(a) What is one way that individuals were affected as a result of Hurricane Katrina?

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(b) Describe how four (4) industries were affected as a result of Hurricane Katrina.

1.
2.
3.
4.

7. Use the information found under the section "Environmental Effects" to answer the following questions.

(a) How was the land affected by Hurricane Katrina?

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(b) How were ecosystems affected by Hurricane Katrina?

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(c) How was Lake Pontchartrain affected by Hurricane Katrina?

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## **Dangers to Human Health after Natural Disasters such as Hurricane Katrina**

Go to the following website:

[http://news.nationalgeographic.com/news/2005/09/0930\\_050930\\_katrina\\_health\\_2.html](http://news.nationalgeographic.com/news/2005/09/0930_050930_katrina_health_2.html). Use the information on the site to answer the following questions.

1. Because of the industrial use of the water in and around New Orleans, what potentially dangerous substances does the sediment in the water contain?

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2. After the storm surge, even sewage treatment plants in New Orleans and the Gulf Coast region were under water for an extensive amount of time. What threat does this pose to human health?

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3. Look under the section titled "Protection Kits".  
List the five (5) items that should be contained in "Protection Kits".

1.	2.
3.	4.
5.	

4. Look under the section titled "Toxic Mold Blooms".  
a) Describe the problem of toxic mold blooms.

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- b) How should mold be dealt with?

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c) What health problems could mold cause?

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5. Describe what is being contracted by humans due to contact with unclean water.

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6. Look under the section titled "Disaster Response Care".  
Explain how the poorer living conditions of many of the people affected most by Hurricane Katrina are adding to the health problems in these areas.

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# Environmental Science, Grade 11, **SVN3E**

## Workplace Preparation

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Go to the website: <http://www.bt.cdc.gov/disasters/hurricanes/recovery.asp>. Complete the following questions.

8. Click on the topic "Prevent Illness & Injuries".
- (a) Describe the precautionary measures that should be taken before using any water after a natural disaster such as Katrina.

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- (b) Find the "Preventing Carbon Monoxide Poisoning after an Emergency" fact sheet. How is carbon monoxide poisoning a potential danger after a hurricane?

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9. Why should you stay away from stray animals after a natural disaster?

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Water Quality Monitoring	
Assessment of Learning:	<p><b>Goal</b></p> <p>Students will analyze the health of a local body of water by either:</p> <ul style="list-style-type: none"> <li>(i) testing the water periodically using water test kit tablets or</li> <li>(ii) monitoring the number and diversity of benthic macro invertebrate</li> </ul> <p><b>Standards for Student Success</b></p> <p>Students will create a report that must include:</p> <ul style="list-style-type: none"> <li>➤ the purpose of the report and the importance of monitoring water quality</li> <li>➤ a description of the body of water being monitored (location, proximity to industrial/residential areas, etc.) as well as the indicators monitored and how they were monitored</li> <li>➤ an explanation of their findings</li> <li>➤ recommendations based on findings and accepted indicator levels</li> </ul> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>B1.</b> analyse selected current environmental problems in terms of the role human activities have played in creating or perpetuating them, and propose possible solutions to one such problem;</p> <p><b>B2.</b> investigate air quality in natural and disturbed environments, using appropriate technology;</p> <p><b>B3.</b> demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored;</p> <p><b>C3.</b> demonstrate an understanding of the ways in which environmental factors can affect human health and how their impact can be reduced.</p>

### Planning Notes

- The **Checkpoints** and **Lesson Sequence** for the water quality monitoring activity will depend on whether water quality will be evaluated by using test kits available from science stores (e.g., Boreal, Sargent-Welch, etc.) or by monitoring the diversity and abundance of benthic macro-invertebrates.
- If using water test kits, a comparison between tap water and local body of water could be investigated by monitoring of both over a period of 4 – 6 weeks. The data collected can be graphed to compare the levels of various indicators in both drinking and natural water systems.
  - Included is a worksheet that the students can use to organize the data collected while performing the urban water quality test. The table was created to go with the *Urban Water Test Kit*, which is available from science stores. Along with the 10 indicators of water quality that the kit includes tests for, colour and odour were also added to the list as these two indicators provide information about the health of a water system as well. The data collected can be used by the students when creating their report on local water quality.

- If monitoring the diversity and abundance of benthic macro-invertebrates, contact your local conservation authority to see whether they offer educational outreach programs on benthic monitoring. In some cases, such organizations will provide teacher training, come out to the school, provide all necessary equipment and assist the students in the analysis and classification of the macro-invertebrates.
  - Included are three sets of worksheets that can be used with the benthic macro-invertebrate monitoring.
  - The titles of the worksheets are: *Water Quality Monitoring*; *BMI Monitoring*; and *Viewing Specimens using a Compound Microscope*.
  - The worksheets are adapted from the resource manual provided by Citizen's Environmental Watch (see resource list below).
  - WATER MONITORING IS TO BE CONDUCTED ONLY BY SOMEONE QUALIFIED TO DO SO.
- With both methods, the students will need to research how each is used as an indicator of the health of the body of water (i.e., *What do high pH levels indicate? What about positive tests for choliform? What does the presence of certain macro-invertebrates indicate about the health of the body of water?*)

### Suggested Resources

#### *Teaching Content Literacy*

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

#### *Water Quality Monitoring with a Water Test Kit*

- You will need to purchase a water test kit from a science supply company. These test kits usually come with the necessary tablets in blister packs of 10 and all the instructions. A simple kit may include test tablets for testing 5 indicators of water quality whereas a more complete kit may include test tablets for testing 12 or more indicators of water quality.

#### *Water Quality Monitoring with Benthic Macro Invertebrates*

- Citizens' Environmental Watch. *Water Quality Monitoring with Benthic Macroinvertebrates: Field Manual, Fall 2008*. Toronto: Citizens' Environmental Watch, 2008.
- Earth Force GREEN. "Benthic Macroinvertebrates as Water Quality Indicators – Poster." nd. 21 February 2009.  
<http://www.eeweek.org/assets/files/Water%20Quality%20Testing/Macroinvert%20poster.pdf>

*Miscellaneous*

- Ryerson University – News and Events. “Something is in the water: Aquatic organisms may provide early warnings of toxins.” 17 October 2008. Ryerson University. 21 February 2009.  
<[http://www.ryerson.ca/news/news/Research\\_News/20081017\\_mccarthy.html](http://www.ryerson.ca/news/news/Research_News/20081017_mccarthy.html)>
- Common Threads. “Tapped Out: The World Water Crisis.” 2009. OSSTF/FEÉSO. 21 February 2009.  
<<http://www.commonthreads.ca/projects/water/index.htm>>
- Engineers Without Borders. “Water for the World – School Outreach Program.” nd. EWB - ISF Canada. 21 February 2009. <  
<<http://www.ewb.ca/en/whatwedo/canada/projects/hso/students/w4w/index.html>>

<b>Goal</b>	<p><b>To write a report based on experimental evidence about the quality of the water in a local stream for Toronto City Council</b></p> <p>While pursuing this goal, students will:</p> <ul style="list-style-type: none"><li>• Deepen their understanding of the role that government plays in monitoring water quality and the need for such monitoring</li><li>• Develop an understanding of the connection between human activity, human health and the environment</li><li>• Learn about writing scientific reports</li></ul>
<b>Role</b>	<p>The student will assume the role of an environmental consultant hired by the city of Toronto to conduct water quality monitoring of a local stream and report their findings to city council</p>
<b>Audience</b>	<p>The audience will be Toronto city council.</p>
<b>Scenario</b>	<p>In an effort to clean up <i>green spaces</i> in the city, the City of Toronto is monitoring the quality of water in local streams. You have been hired to conduct monitoring experiments of a stream, report your findings and make recommendations to city council.</p>
<b>Product and/or Performance</b>	<p>The Mayor of Toronto has requested a written report of your findings</p>
<b>Standards for Success</b>	<p>Your report must meet the following standards:</p> <ul style="list-style-type: none"><li>➤ Explain the purpose of your report and the importance of monitoring water quality</li><li>➤ Describe the area around stream, what indicators of water quality were being monitored and how they were monitored</li><li>➤ Present your findings in an appropriate format and explain their meaning</li><li>➤ Discuss how your findings compare to accepted levels for the monitored indicators and make recommendations for improving water quality</li></ul>

Urban Water Quality Monitoring – Data Table

Testing for:	WEEK 1		WEEK 2		WEEK 3	
	Tap Water	Stream Water	Tap Water	Stream Water	Tap Water	Stream Water
Coliform						
Chlorine						
Copper						
Dissolved oxygen						
Hardness						
Iron						
Nitrates						
pH						
Phosphates						
Temperature						
Colour						
Odour						

Environmental Science, Grade 11, SVN3E

Workplace Preparation

Testing for:	WEEK 4			WEEK 5			WEEK 6	
	Tap Water	Stream Water	Tap Water	Tap Water	Stream Water	Tap Water	Stream Water	Tap Water
Coliform								
Chlorine								
Copper								
Dissolved oxygen								
Hardness								
Iron								
Nitrates								
pH								
Phosphates								
Temperature								
Colour								
Odour								

## Water Quality Monitoring

What are benthic macro-invertebrates?

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What is an ecosystem?

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Why monitor ecosystems?

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What indicators can we use to monitor water quality? What are the pros and cons of each?

Type	Examples	Pros	Cons

What is the difference between point and non-point sources?

Point Source	Non-Point Source

How can water quality be impacted?

Impact	Natural or Human	Point or Non-Point Source	Short Term Effects	Long Term Effects

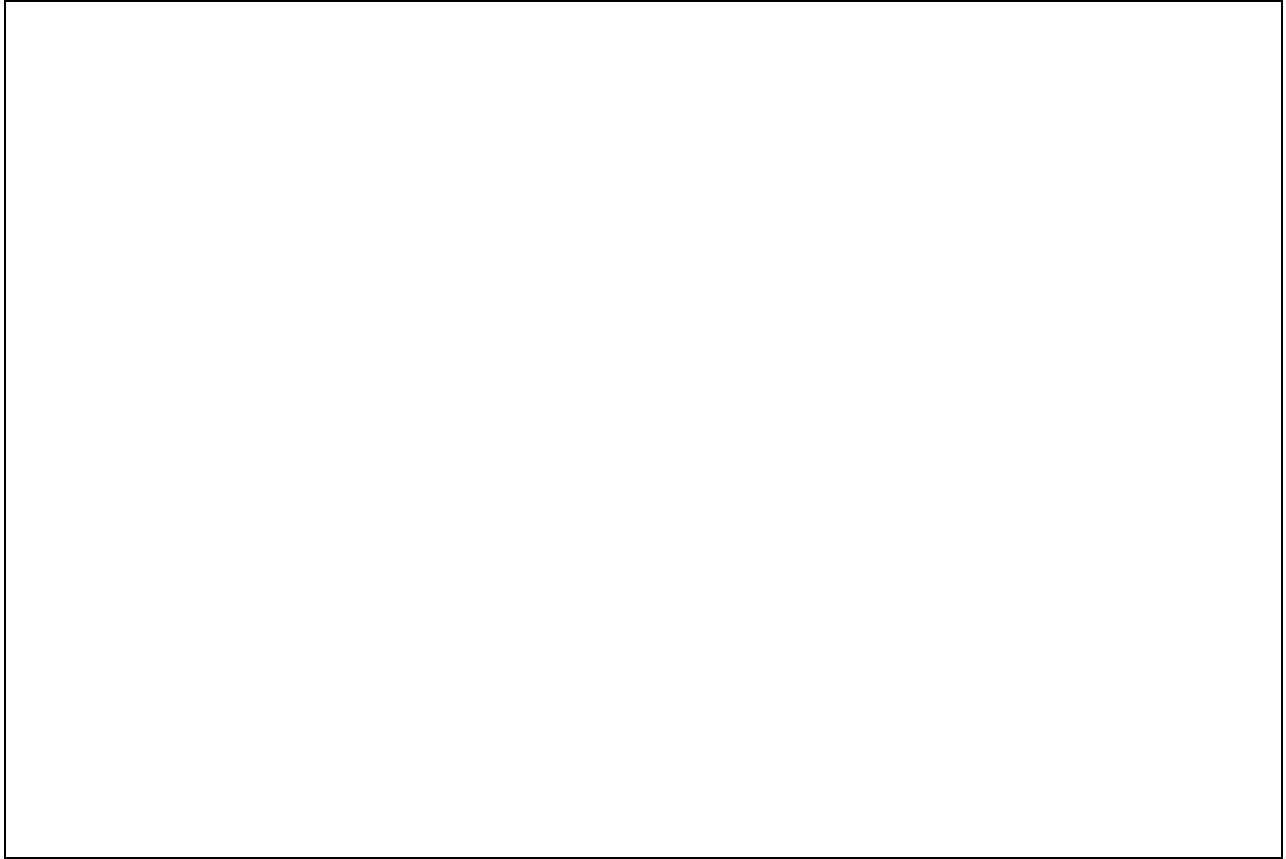
### Key Components of Streams and Rivers

Component	Definition
Current	
Flow	
Pools	
Riparian Zone	
Riffles	
Substrate	
Watercourse	
Watershed	

### Activity

Sketch a hypothetical section of a stream and label the following items:

- ☐ direction of current
- ☐ riparian zones
- ☐ riffles
- ☐ pools
- ☐ likely substrates in different areas of the stream
  - sand
  - silt
  - pebbles
  - boulders
- ☐ a point source of pollution
- ☐ a non-point source of pollution



### **BMI Monitoring**

Why is accuracy needed in science?

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What are the different types of vegetation (riparian zones) that can be found in nature?

<b>Riparian Zone</b>	<b>Description</b>
1.	
2.	
3.	
4.	
5.	

What are the different types of substrates that can be found in nature?


### **BMI Indicators**

- There are 27 BMI indicators that vary in tolerance to pollution
- The BMI are found in three (3) stages; adult, larva, and nymph
- Larvae – 88% of insects, worm-like, don't resemble adults e.g. mosquito
- Nymph – 12% of insects, resemble adults (baby version) e.g. dragonfly

#### **Group A – Adults, no legs (7 types)**

- Shells: Clams or Snails
- Tentacles: Hydra
- Flat Body: Flatworms or Leeches
- Round Body: Roundworms or Aquatic Earthworms

#### **Group B – Larva, no legs (7 types)**

- Chubby, leathery body: Flies – Horseflies, Crane Flies, Miscellaneous Flies, Black Flies
- Thin, smooth, segmented body: No-see-ums or Midge
- Large head: Mosquito

#### **Group C – Nymph with legs (4 types)**

- Dragonfly
- Damselfly
- Mayfly
- Stonefly

#### **Group D – Adult with legs (6 types)**

- 3 pairs of legs: True bugs or Beetles
- More than 3 pairs of legs: Water Mites, Scuds, Sow bugs, Crayfish

## Field Trip Review

### A. Site Set-Up

**NOTE – Try to go in the water as little as possible until all of the sampling has been collected.**

1. Walk the site and locate a riffle and find a “cross-over” point (level banks and uniform depth). Mark this location as the downstream limit.
2. Walk upstream approximately 40 metres and locate another crossover. You need at least one pool/riffle sequence. Mark this spot as the downstream limit.
3. Measure the distance between 2 markers as close to the edge of the stream as possible and record the site length and **record on data sheet.**
4. Measure the narrowest point between the 2 markers to determine the number of transects needed and **record on data sheet.**

*Determining the Number of Transects Based on Stream Width*

Minimum Stream Width	Number of Transects
Less than 1 metre	10
1 to 1.5 metres	8
Greater than 1.5 metres	6
Greater than 3 metres	5

5. Calculate the spacing between transects to get even spacing using the following equation;

$$\frac{\text{Stream Length}}{\text{\# of transects} - 1}$$

6. Mark out transects and **sketch the site on your data sheet.**

### B. Collecting Sample

1. Start downstream at transect #1. One person holds the D-net approximately 1cm above the substrate facing upstream. The other person stands and kicks for approximately 1 minute.
2. Slowly shuffle toward the marker on the opposite stream bank. Pick up any embedded rocks and rub their surface to remove any BMI.
3. Once on the opposite bank, cross back downstream from transect #1 or hop across if possible.

4. Empty your D-net into the sieve over a waste bucket. Use squeeze bottles with water from the stream to rinse the net. Look for any bugs that may be caught.
5. Remove debris from the sieve. Be sure to rinse off all debris before discarding it.
6. Pour waste bucket through sieve to be sure that no BMI escaped into the bucket.
7. Transfer the sieved sample into the "sample bucket". Some stream water can be added to help with sub-sampling.

### **C. Sub-Sampling**

1. Stir the contents of the bucket gently to mix it well.
2. Scoop a portion of the sample with a measuring cup to create a "sub-sample".
3. Transfer your sub-sample into a smaller bucket to begin picking and sorting. **After sorting, return contents to sample bucket.**

### **D. Picking**

1. **Record the time that you begin picking on your data sheet.**
2. Carefully distribute your sub-sample contents.
3. Look for smaller bugs, moving bugs, and resting bugs not just large ones. **Once a bug is spotted, it must be picked so that data is valid.**
4. Transfer each picked bug into an ice cube tray with tweezers or a pipette.
5. If 2 minutes have passed and no bugs are seen and you have not reached 100 bugs, get a new sub-sample.

### **E. Identifying**

1. Use your notes, keys, and hand magnifiers to identify BMI.
2. Sort each bug into separate cube trays.
3. Do not count any dead bugs.
4. Any doubts, **ask me!**
5. **Record the time you stop picking and sorting on the data sheet.**

### Field Trip Roles

Description	Name(s)
Site Length and Minimum Wetted Width Measured	
Transect Calculations	
Site Sketch (transects, riparian data, pertinent features, north, flow, pools, riffles)	
Site Description	
Photographer (first and last transects both up and downstream, various)	
Riparian Data	
Transect Width	
Substrate Data	
Overhead Stream Cover	
Collection	
Sorting	
Probeware (temperature, pH)	
Waste Collection	
Clean Up	

## **Viewing Specimens using a Compound Microscope**

We will be using our microscope skills and knowledge of benthic macro-invertebrates, to take a closer look at our specimens in order to ensure that they were identified properly.

### **PRECAUTIONS**

1. Microscope slides are made of glass, so be very careful. If they break, let me know so the glass can be properly disposed of.
2. Clean up work area and wash your hands at the end of the activity.
3. To unplug the microscope, pull on the plug, not the cord.

### **MATERIALS**

- |    |    |
|----|----|
| 1. | 5. |
| 2. | 6. |
| 3. | 7. |
| 4. | 8. |

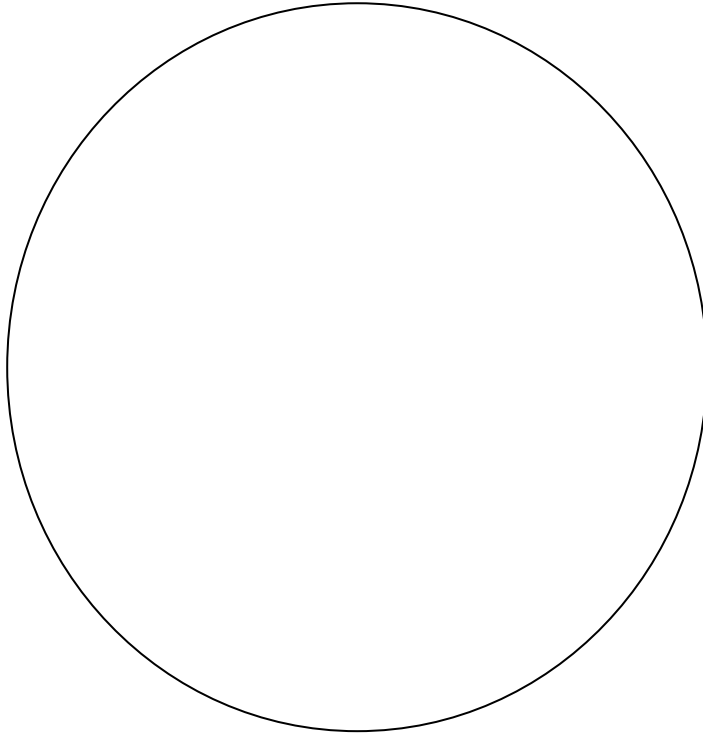
### **PROCEDURE**

1. Properly set up your microscope and gather all of the necessary materials.
2. Obtain a specimen from the teacher.
3. Place the specimen on the slide and insert the slide under the stage clips within the field of view. Remember that the microscope should be on low power prior to viewing.
4. Use the coarse-adjustment knob to bring the lens as close as it will go to the stage without touching the specimen and begin focusing. Turn the fine-adjustment knob to get the best focus possible. If the image appears to be smudged, clean both lenses with lens paper.
5. Remember, that when you are looking through the ocular lens to keep both eyes open to reduce the amount of strain on your eyes.
6. Make a proper biological drawing of what you see under the field of view. Be sure to include magnification and a title. Double check with your BMI descriptor sheets to be sure that all specimens were properly identified.
7. Repeat the above steps for each of the specimens we collected.
8. **NOTE** - You will not need to go any higher than low power for this activity.

**OBSERVATIONS**

Specimen # \_\_\_\_\_ - \_\_\_\_\_

Magnification: \_\_\_\_\_



Renewable Energy Design Project	
Assessment of Learning:	<p><b>Goal</b></p> <p>Students will design, build and test a working model of a device that uses renewable energy to perform a specific function. They will choose between one of three models: a model of a wind turbine that converts wind energy into either electrical or mechanical energy; a solar oven that converts solar energy into thermal energy; or a passive water heater that converts solar energy into kinetic energy. The students will communicate the effectiveness of their device in performing its specified function.</p> <p><b>Standards for Student Success</b></p> <p>Students will create a presentation that must include:</p> <ul style="list-style-type: none"> <li>➤ Include a model of their device</li> <li>➤ An explanation of how their device works to harness a renewable source of energy to perform its task</li> <li>➤ A description of how they tested their device and what they discovered</li> <li>➤ Recommendations on how their device could be improved</li> </ul> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>A2.</b> identify, and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields;</p> <p><b>D1.</b> evaluate initiatives and technological innovations related to energy consumption and conservation, and assess their impact on personal lifestyles, social attitudes, and the environment;</p> <p><b>D2.</b> investigate various methods of conserving energy and improving energy efficiency;</p> <p><b>D3.</b> demonstrate an understanding of the basic principles of energy production, with reference to both renewable and no-renewable sources, and of various methods of energy conservation.</p>

# Environmental Science, Grade 11, **SVN3E**

## Workplace Preparation

<b>Assessment for Learning</b>	<p><b>Checkpoint # 1: (after completion of lesson 3, Energy Consumption)</b> Students will collect and organize data about home energy consumption. They will produce a data table and organize the data into a graphical form in order to visualize trends in home energy consumption. They will analyze how these trends affect the amount due on their monthly hydro bill. The tables and graphs may be produced by hand or using technology (Excel, Lotus etc...).</p> <p><b>Checkpoint # 2: (after completion of lesson 4, Non-renewable Energy Production)</b> Students will demonstrate the ability to differentiate between renewable and non-renewable sources of large scale energy production. Furthermore, they will be able to demonstrate some of the advantages and disadvantages of each of the forms of non-renewable energy production.</p> <p><b>Checkpoint # 3: (after completion of lesson 5, Renewable and Sustainable Energy Production)</b> Students will demonstrate the ability to differentiate between the concept of renewable and sustainable energy production. Furthermore, they will demonstrate specialized knowledge of one of the major forms of renewable and sustainable large scale energy production by presenting their research to their peers.</p> <p><b>Checkpoint # 4: (after completion of lesson 6, Energy Efficiency)</b> Students will demonstrate an awareness and understanding of emerging technologies in the automotive industry and/or home appliances, building materials, construction methods and home renovations that serve to improve society's energy efficiency and therefore our ecological footprint.</p> <p><b>Checkpoint # 5: (after completion of lesson 7, Energy Conservation)</b> Students will demonstrate an awareness and understanding of how their personal decision making processes leads to the unnecessary consumption of energy. Furthermore, they will demonstrate knowledge of small scale energy production technologies that could reduce their energy demands upon the large scale infrastructure.</p>
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<b>Suggested Lesson Sequence</b>		<b>Approx. Duration</b>
<b>Lesson 1</b>	<p><b>Lesson Goal</b></p> <p>Through the use of strategies such as “Know What Learn”, “Think-Pair-Share”, “List Group Label”, group brainstorming and/or the use of anticipation guides, the teacher will elicit the students’ prior knowledge of concepts and vocabulary with respect to energy consumption.</p>	1 class
<b>Lesson 2</b>	<p><b>Lesson Goal</b></p> <p>The teacher will use a guided reading strategy to scaffold students towards becoming proficient in reading, recording and understanding how home electricity meters measure energy consumption. Furthermore, using the above strategies, the student will explore and explain all of the charges on a typical monthly electricity bill.</p>	1 class
<b>Lesson 3</b>	<p><b>Lesson Goal</b></p> <p>The student, using information provided in the EnerGuide, will evaluate the annual energy consumption of a variety of appliances and fixtures within their home.</p> <p><b>Worksheet:</b></p> <ul style="list-style-type: none"> <li>➤ Tracking Your Household Energy Consumption &amp; Cost</li> </ul>	2 classes

# Environmental Science, Grade 11, **SVN3E**

## Workplace Preparation

Lesson 4	<p><b>Lesson Goal</b></p> <p>The students will investigate the various large-scale non-renewable methods by which energy is currently produced in Ontario. The student will then explore how these methods are employed from province to province and develop a power production profile across Canada.</p> <p><b>Worksheet:</b></p> <ul style="list-style-type: none"> <li>➤ Comparison Matrix: Non-renewable Energy Sources</li> </ul>	4 classes
Lesson 5	<p><b>Lesson Goal</b></p> <p>Through the use of strategies such as “Know What Learn”, “Think Pair Share”, group brainstorming, the use of anticipation guides and/or guided reading, the teacher will scaffold the students towards developing and practicing independent research, inquiry and presentation skills. Specifically, students will produce and present their research about one form of large-scale renewable and sustainable energy production.</p>	6 classes
Lesson 6	<p><b>Lesson Goal</b></p> <p>Students will transfer and apply their newly emerging knowledge and understanding of renewable and sustainable large-scale energy production to explore and analyze residential construction practices or alternative automotive engine technologies as a means of becoming more energy efficient.</p>	3 classes
Lesson 7	<p><b>Lesson Goal</b></p> <p>The teacher will lead the class in reviewing all of the current large-scale methods of energy production, both non-renewable and renewable. The teacher will enable students to develop an awareness and understanding of small-scale applications for power generation. Students will relate the need to implement small-scale technologies based upon our current behaviours that drive the demand for electricity.</p>	3 classes
Lesson 8	<p><b>Culminating Performance Task</b></p> <p>Students will design and build a device that can produce power using an alternative and sustainable means. They will choose between one of three projects, they may build a wind turbine a solar oven, or a passive water heater.</p>	5 classes

### Suggested Resources

#### *Teaching Content Literacy*

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

*Reading a home electricity meter*

- “Watts On Your Mind? Solar Energy Educational Activities for Schools.” nd. CSG Services Inc. 22 February 2009. <[www.wattsonschoools.com/pdf/m-3.pdf](http://www.wattsonschoools.com/pdf/m-3.pdf)>
- Gajewski, Stan, et al. *Science Essentials 10*. Toronto: MHR, 2007

*Understanding your monthly electricity bill*

- A sample copy of a monthly electricity bill can be found on the website of the company that provides electricity to your area. For instance, a sample of a monthly electricity bill for the city of Toronto is found at:  
[www.torontohydro.com/electricsystem/understanding\\_your\\_bill/bill\\_breakdown/index](http://www.torontohydro.com/electricsystem/understanding_your_bill/bill_breakdown/index)

*Energy consumption tables*

- ABS Alaskan. “Power Consumption Table.” 10 January 2008. ANS Alaskan, Inc. 22 February 2009. <[www.absak.com/library/power-consumption-table](http://www.absak.com/library/power-consumption-table)>

*Renewable and Non-renewable Energy Production*

- Energy Information Association. “Canada.” May 2008. U.S.A. Government – Department of Energy. 19 March 2009.  
<<http://www.eia.doe.gov/cabs/Canada/Background.html>>
- The Ontario Green News. “Electricity in Ontario.” July 23, 2003. University of Guelph. 19 March 2009.  
<[http://www.uoguelph.ca/~whulet/OGN/Vol1Issue1/Glen\\_Estill.htm](http://www.uoguelph.ca/~whulet/OGN/Vol1Issue1/Glen_Estill.htm)>
- The NEED Project. “Putting Energy into Education.” 2009. National Energy Educational Development Project. 22 February 2009. <[www.need.org](http://www.need.org)>
- Comparison Matrix for Non-Renewable Energy (found at end of resource list)
- NOVA Science Programming On Air and Online. “Saved by the Sun.” nd. PBS. 22 February 2009. <[www.pbs.org/nova/solar](http://www.pbs.org/nova/solar)>
- Greenlearning.ca. “Welcome to GreenLearning.” 2009. The Pembina Foundation. 22 February 2009. <[www.greenlearning.ca](http://www.greenlearning.ca)>
- re-energy.ca. “Renewable Energy Project Plans to Build Working Models.” nd. The Pembina Foundation. 22 February 2009. <[www.re-energy.ca](http://www.re-energy.ca)>

*Miscellaneous*

- Alliance to Save Energy. “Energy Hog.org.” nd. 22 February 2009. <[www.energyhog.org](http://www.energyhog.org)>
- Bibla, Steve. *The Toronto Wind Turbine: Excursion for Kids 2<sup>nd</sup> Ed.*, Toronto District School Board and Toronto Hydro Cooperation, 2008.
- *Scienceworld* Articles
  - “Hands On Science Absorption” – April 16, 2007
  - “Light Flights” - December 8, 2008
  - “Hot Wheels” – April 16, 2007
  - “The Scoop on Oil” – September 1, 2008
  - “Gas Bags” – October 6, 2008

- “Warning Signs” – October 6, 2008
- “Take Action, Go Green” – April 16, 2007
- Gorrie, P. “Biofuels Not Miracle Cure, Studies Say.” *Toronto Star* 8 February 2008: <http://www.thestar.com/article/301676>
- Miller, T. “Green Buildings Take Root in Cities, School.” 26 Dec. 2006. MacNeil/Lehrer Publications. 21 February 2009.  
< [http://www.pbs.org/newshour/extra/features/july-dec06/green\\_12-26.html](http://www.pbs.org/newshour/extra/features/july-dec06/green_12-26.html) >
- Ingram, Jay. *The Daily Planet Book of Cool Ideas*. Toronto: Penguin Group, 2008

<b>Goal</b>	<p><b>To persuade a homeowner to purchase energy from a renewable energy source*</b></p> <p>While pursuing this goal, students will:</p> <ul style="list-style-type: none"><li>• Deepen their understanding of the role that both energy conservation and renewable sources of energy play in meeting our energy needs</li><li>• Develop an understanding of the connection between conservation of energy, acid rain, climate change and human health</li><li>• Learn about persuasive communication techniques</li></ul>
<b>Role</b>	<p>All students assume the same role. All students pretend that they work as a salesperson who has to convince homeowners to purchase a renewable source of energy (<i>e.g.</i>, solar, wind, geothermal)</p>
<b>Audience</b>	<p>The audience is reluctant homeowners who are concerned about the increasing cost for energy and do not see any benefits to switching to a renewable source of energy production.</p>
<b>Scenario</b>	<p>A salesperson of a renewable source of energy has a tough job selling renewable energy to homeowners. It costs more money (either from the energy supply company or as an initial set-up of necessary equipment) than from a conventional supplier. Homeowners often ask challenging questions of door-to-door salespersons.</p>
<b>Product and/or Performance</b>	<p>Students will:</p> <ul style="list-style-type: none"><li>• Keep a folder of their work (handouts, research notes) for assessment purposes</li><li>• Submit a written summary of their pitch to be evaluated by their teacher</li><li>• Role-play an energy salesperson to “sell” renewable energy to 3 other teachers in the school to be evaluated by those teachers</li><li>• A brochure summarizing the benefits of using the renewable energy source that you are “selling”</li></ul>

\* Modified from *The Toronto Wind Turbine: An Excursion for Kids* by Steve Bibla

# Environmental Science, Grade 11, SVN3E

## Workplace Preparation

### GRASP Activity – Marking Rubric

Level 1 (50 - 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
<b>Knowledge/Understanding</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>demonstrates limited knowledge of a renewable energy source</li> <li>demonstrates limited understanding of the consequences of using non-renewable sources of energy production</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates some knowledge of a renewable energy source</li> <li>demonstrates some understanding of the consequences of using non-renewable sources of energy production</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates considerable knowledge of a renewable energy source</li> <li>demonstrates considerable understanding of the consequences of using non-renewable sources of energy production</li> </ul>	<ul style="list-style-type: none"> <li>demonstrates thorough knowledge of a renewable energy source</li> <li>demonstrates thorough understanding of the consequences of using non-renewable sources of energy production</li> </ul>
<b>Thinking/Inquiry/Problem Solving</b>			
<p>The Student:</p> <ul style="list-style-type: none"> <li>identifies the problems associated with using non-renewable energy sources with limited effectiveness</li> <li>gathers and records information about renewable and non-renewable sources of energy with limited effectiveness</li> <li>evaluates the impact of energy production from non-renewable sources on human health and the environment with limited effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies the problems associated with using non-renewable energy sources with some effectiveness</li> <li>gathers and records information about renewable and non-renewable sources of energy with some effectiveness</li> <li>evaluates the impact of energy production from non-renewable sources on human health and the environment with some effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies the problems associated with using non-renewable energy sources with considerable effectiveness</li> <li>gathers and records information about renewable and non-renewable sources of energy with considerable effectiveness</li> <li>evaluates the impact of energy production from non-renewable sources on human health and the environment with considerable effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>identifies the problems associated with using non-renewable energy sources with a high degree of effectiveness</li> <li>gathers and records information about renewable and non-renewable sources of energy with a high degree of effectiveness</li> <li>evaluates the impact of energy production from non-renewable sources on human health and the environment with a high degree of effectiveness</li> </ul>

# Environmental Science, Grade 11, SVN3E

## Workplace Preparation

Communication				
The Student:	<ul style="list-style-type: none"> <li>expresses information in sales pitch and organizes an information sheet/brochure with limited clarity</li> <li>communicates, to a homeowner, the problem of increasing energy costs with a limited sense of purpose</li> <li>creates an information sheet/brochure, using a computer publishing program, with limited effectiveness</li> <li>demonstrates limited logic when creating a sales pitch</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in sales pitch and organizes an information sheet/brochure with some clarity</li> <li>communicates, to a homeowner, the problem of increasing energy costs with some sense of purpose</li> <li>creates an information sheet/brochure, using a computer publishing program, with some effectiveness</li> <li>demonstrates some logic when creating a sales pitch</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in sales pitch and organizes an information sheet/brochure with considerable clarity</li> <li>communicates, to a homeowner, the problem of increasing energy costs with considerable sense of purpose</li> <li>creates an information sheet/brochure, using a computer publishing program, with considerable effectiveness</li> <li>demonstrates considerable logic when creating a sales pitch</li> </ul>	<ul style="list-style-type: none"> <li>expresses information in sales pitch and organizes an information sheet/brochure with a high degree of clarity</li> <li>communicates, to a homeowner, the problem of increasing energy costs with a high degree of purpose</li> <li>creates an information sheet/brochure, using a computer publishing program, with thorough effectiveness</li> <li>demonstrates thorough logic when creating a sales pitch</li> </ul>
Applications				
The Student:	<ul style="list-style-type: none"> <li>applies understanding of the methods of conserving energy and improving energy efficiency with limited effectiveness</li> <li>transfers understanding of energy consumption, waste and conservation to inform a homeowner with limited detail</li> <li>makes connection between energy sources and human health and the environment with limited comprehension</li> <li>proposes recommendations, to a homeowner, to problem of increasing energy costs with limited clarity</li> </ul>	<ul style="list-style-type: none"> <li>applies understanding of the methods of conserving energy and improving energy efficiency with some effectiveness</li> <li>transfers understanding of energy consumption, waste and conservation to inform a homeowner with some detail</li> <li>makes connection between energy sources and human health and the environment with some comprehension</li> <li>proposes recommendations, to a homeowner, to problem of increasing energy costs with some clarity</li> </ul>	<ul style="list-style-type: none"> <li>applies understanding of the methods of conserving energy and improving energy efficiency with considerable effectiveness</li> <li>transfers understanding of energy consumption, waste and conservation to inform a homeowner with considerable detail</li> <li>makes connection between energy sources and human health and the environment with considerable comprehension</li> <li>proposes recommendations, to a homeowner, to problem of increasing energy costs with considerable clarity</li> </ul>	<ul style="list-style-type: none"> <li>applies understanding of the methods of conserving energy and improving energy efficiency with a high degree of effectiveness</li> <li>transfers understanding of energy consumption, waste and conservation to inform a homeowner with a high degree of detail</li> <li>makes connection between energy sources and human health and the environment with a high degree of comprehension</li> <li>proposes recommendations, to a homeowner, to problem of increasing energy costs with a high degree of clarity</li> </ul>

**Goal**                      **To build and test a model of a device that uses a renewable source of energy production**

While pursuing this goal, students will:

- Deepen their understanding of the role that government plays in monitoring water quality and the need for such monitoring
- Develop an understanding of the connection between human activity, human health and the environment
- Learn about writing scientific reports

**Role**                      The student will assume the role of an applicant applying for an junior engineering position with an environmental engineering firm

**Audience**            The audience will be the hiring committee at the engineering firm.

**Scenario**              You have applied for a position as a junior engineer with an engineering firm that develops devices which rely on renewable energy for their power. You have made it to the final stage on the interview process. For the final stage you are to create a model of either a (i) wind turbine; (ii) solar cooker; or (iii) passive water heater.

**Product and/or Performance**      The hiring committee has requested that you design, build and test a model of your device and present your model to the committee.

**Standards**              Your presentation must meet the following standards:

- for Success**
- Include a model of your device
  - An explanation of how your device works to harness a renewable source of energy to perform its task
  - A description of how you tested your device and what you discovered
  - Recommendations on how your device could be improved

### Tracking Your Household Energy Consumption & Costs

For this activity you will compare the monthly and yearly energy consumption and cost of operating 5 different household appliances or electronic equipments.

Appliance	Approx. Age	Power Rating <sup>A.</sup>	Hour(s) used (per day)	Energy Consumed (per day) <sup>B.</sup>	Energy Consumed (per month) <sup>C.</sup>	Energy Consumed (per year) <sup>D.</sup>	Cost (per month) <sup>E.</sup>	Cost (per year) <sup>F.</sup>

## Environmental Science, Grade 11, SVN3E

### Workplace Preparation

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The following will assist you in completing your chart:

- A. Your teacher will have information about the power rating for a number of different appliances and/or electronic devices categorized by approximate age.

- B. The formula for calculating Energy Consumed (per day) is:

$$\text{Energy Consumed (per day)} = \frac{\text{Power Rating (in watts)} \times \text{Hours Used}}{1000}$$

- C. The formula for calculating Energy Consumed (per month) is:

$$\text{Energy Consumed (per month)} = \text{Energy Consumed (per day)} \times 30$$

- D. The formula for calculating Energy Consumed (per year) is:

$$\text{Energy Consumed (per year)} = \text{Energy Consumed (per month)} \times 12$$

- E. The formula for calculating Cost (per month) is:

$$\text{Cost (per month)} = \text{Energy Consumed (per month)} \times \text{Energy Cost}$$

- F. The formula for calculating Cost (per year) is:

$$\text{Cost (per year)} = \text{Energy Consumed (per year)} \times \text{Energy Cost}$$

- ☐ Your teacher will also provide you with the most current cost of energy (in ¢/kWh) based on information found in a monthly electricity bill.
- ☐ Have your calculations checked before creating your graphs.

# Environmental Science, Grade 11, SVN3E

## Workplace Preparation

CHARACTERISTIC	Non-Renewable Energy Sources		
	Fossil Fuels	Coal	Nuclear
What are they?/What is it?			
			Similarities
			Differences
How is it formed into an energy source?			
			Similarities
			Differences
Where can they be found?			
			Similarities
			Differences
What are the advantages of this energy source?			
			Similarities
			Differences
What are the disadvantages of this energy source?			
			Similarities
			Differences

## Waste Management

Assessment of Learning:	<p><b>Goal</b></p> <p><b>Standards for Student Success</b></p> <p>Students will</p> <p><b>Overall Expectations Evaluated</b></p> <p><b>A1.</b> demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p><b>B2.</b> investigate soil quality in natural and disturbed environments, using appropriate technology;</p> <p><b>B3.</b> demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored;</p> <p><b>C3.</b> demonstrate an understanding of the ways in which environmental factors can affect human health and how their impact can be reduced.</p>
Assessment for Learning	<p><b>Checkpoint:</b></p> <p><b>Checkpoint:</b></p> <p><b>Checkpoint:</b></p>

Suggested Lesson Sequence		Approx. Duration
Lesson 1	<b>Lesson Goal</b> Student's prior knowledge about the topic will be activated using the 4-Corners activity. Using List-Group-Label strategies, the students will compare the list they produced with the other members of their group and come up with a list of common words/phrases/sentences. The group's common list will be shared with the rest of the class and an appropriate task about <i>waste management</i> will be developed out of the class list.	1 class
Lesson 2	<b>Lesson Goal</b>	
Lesson 3	<b>Lesson Goal</b>	
Lesson 4	<b>Lesson Goal</b>	

### Suggested Resources

#### Teaching Content Literacy

- Allen, Janet. *Tools for Teaching Content Literacy*. Markham, ON: Pembroke Publishers, 2004.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Reading, Writing, and Communicating*. Toronto: Queens Printer, 2003.
- *Think Literacy: Cross-Curricular Approaches, Grades 7-12 – Subject-Specific Examples, Science, Locally Developed Compulsory Credit (LDCC) Science, Grade 9 Science, Grades 9-10, 2005*.
- Bennett, Barrie, and Carol Rolheiser. *Beyond Monet: The Artful Science of Instructional Integration*. Toronto: Bookation Inc., 2001.

#### Miscellaneous

- Statistics Canada. "Human Activity and the Environment, Annual Statistics 2005, Solid Waste in Canada." November 2005. Ministry of Industry. 21 February 2009. <<http://dsp-psd.tpsgc.gc.ca/Collection-R/Statcan/16-201-XIE/0000516-201-XIE.pdf>>
- Ontario Ministry of Agriculture, Food & Rural Affairs Publications
  - Best Management Practices: Soil Management
  - Best Management Practices: Nutrient Management Planning
  - Best Management Practices: Water Management
- HowStuffWorks. "How Landfills Work." 2008. Discovery Communications, LCC. 21 February 2009. <<http://science.howstuffworks.com/landfill.htm>>

- Natural Resources Canada. "Geoscape Canada: Geoscape Toronto." 01 March 2008. Public Works and Government Services Canada. 21 February 2009. < [http://www.geoscape.nrcan.gc.ca/toronto/teacher\\_e.php](http://www.geoscape.nrcan.gc.ca/toronto/teacher_e.php) > (Oakridges Moraine Activity 3 – Build a Groundwater Model)
- CBCNews.ca. "Inside the World's Superdumps." 16 December 2008. CBC. 21 February 2009. <[www.cbc.ca/consumer/story/2008/12/08/f-forbes-superdumps.html](http://www.cbc.ca/consumer/story/2008/12/08/f-forbes-superdumps.html)>
- Scienceworld Articles
  - "Down in the Dumps" - March 31, 2008
  - "Paper or Plastic?" – April 21, 2008
- Jambeck, Jenna R.; Andino, Jean M. "Garbage Juice: Waste Management and Leachate Generation." *J. Chem. Ed.* **2007** 84 240A.
- California Integrated Waste Management Board. "Lesson 2: No Household Hazardous Waste in a Landfill." 18 September, 2008. California Integrated Waste Management Board. 21 February 2009. <http://www.ciwmb.ca.gov/Schools/Curriculum/CTL/46Module/Unit4/lesson2.pdf>
- Humboldt State University Center for Indian Community Development. "Curriculum, Grades 1 – 12: Environmental Protection. Native American Lands: A Cultural Approach to Integrated Environmental Studies." (28. *Landfill Pop Bottle*). nd. Humboldt State University & California State University. 21 February 2009. <<http://www.humboldt.edu/~cicd/epa/pdfs/28.LandfillPopBottle.pdf> >

Waste Management & Minimization

Waste Management & Minimization

Waste Management & Minimization

Waste Management & Minimization

<b>Goal</b>	<p>While pursuing this goal, students will:</p> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>
<b>Role</b>	
<b>Audience</b>	
<b>Scenario</b>	
<b>Product and/or Performance</b>	<p>Students will:</p> <ul style="list-style-type: none"> <li>•</li> <li>•</li> <li>•</li> </ul>

## Further Resources for Instructional Planning

- Bibla, Steve. *GRASP: A tool for developing ecological literacy through rich performance tasks*. Toronto District School Board, 2007.
- Chin, Christine, and Li-Gek Chia. "Problem-Based Learning Tools." *The Science Teacher* November 2008: 44-49.
- Colley, Kabba. "Project-Based Science Instruction: A Primer." *The Science Teacher* November 2008: 23-28.
- Dickinson, Gail, and Julie K. Jackson. "Planning for Success: How to design and implement project-based science activities." *The Science Teacher* November 2008: 29-32.
- Gregory, Gayle H., and Carolyn Chapman. *Differentiated Instructional Strategies: One Size Doesn't Fit All*. California: Corwin Press, 2007.
- Groenke, Susan L., and Randall Pucket. "Becoming Environmentally Literate Citizens." *The Science Teacher* November 2006: 22-27.
- Lightbody, Mary. "Investigating Invasives: Students study invasive species and support their local environment." *The Science Teacher* November 2008: 56-60.
- Marzano, Robert J. et. al. *A Handbook for Classroom Management that Works*. Virginia: ASCD, 2005.
- Marzano, Robert J. *The Art and Science of Teaching*. Virginia: ASCD, 2007.
- Marzano, Robert J., Debra J. Pickering, and Jane E. Pollock. *Classroom Instruction that Works*. Virginia: ASCD, 2001.
- Saul, E.W., ed. *Crossing Borders in Literacy and Science Instruction: Perspectives on Theory and Practice*. Virginia: NSTA Press, 2004.
- Short, Harold, Morten F.V. Lundsgaard and Joseph S. Krajcik. "How Do Geekos Stick? Using phenomena to frame project-based science in chemistry classes." *The Science Teacher* November 2008: 39-43.
- Smithenry, Dennis, and Joan Bolos. "Creating a Scientific Community." *The Science Teacher* November 1997: 44-47.
- Weizman, Ayelet, Yael Schwartz and David Fortus. "The Driving Question Board: A visual organizer for project-based science." *The Science Teacher* November 2008: 33-37.
- Wellington, Jerry, and Jonathan Osborne. *Language and Literacy in Science Education*. Buckingham, UK: Open University Press, 2001.